Chapter 1

How children learn language

We have minds and in our minds we have the means for producing and comprehending speech. But how did we come to have such abilities? At birth we cannot comprehend speech, nor can we produce speech. Yet, by the age of 4 years we have learned vocabulary and grammatical rules for creating a variety of sentence structures including negatives, questions, and relative clauses. And although 4-year-olds still have passives and some other elaborate syntactic structures to learn, along with a never-ending stock of vocabulary items, they have already overcome the most difficult obstacles in language learning. This is true of children the world over, whatever the language may be.

Indeed, the language proficiency of the 4- or 5-year-old is often the envy of the adult second-language learner, who has been struggling for years to master the language. It is one of the fundamental tasks of psycholinguists to explain how children learn language.

For reasons that will become apparent later, we will separate language into two distinct, but related, psychological processes: *speech production* and *speech comprehension*. We will deal with each in turn and then consider how they are related.

1.1 The development of speech production

1.1.1 From vocalization to babbling to speech

1.1.1.1 Vocalization to babbling

Prior to uttering speech sounds, infants make a variety of sounds – crying, cooing, gurgling. Infants everywhere seem to make the same variety of sounds, even children who are born deaf (Lenneberg *et al.*, 1965). The ability and propensity to utter such sounds thus appear to be unlearned. Later, around the seventh month, children ordinarily begin to babble, to produce what may be described as repeated syllables ('syllabic reduplication'), e.g. 'baba', 'momo', 'panpan'. While most of the syllables are of the basic *Consonant* + *Vowel* type ('baba' and 'momo'), some consist of closed syllables

of the simple *Consonant + Vowel + Consonant* variety ('panpan'). This structure of babbling as repeated syllables has been found to be produced by children in all studied languages.

The sounds that infants make involve many but not all of the speech sounds that occur in the languages of the world. For example, English sounds like the 'th' in 'though' and the 'th' in 'thin' are rare, as are the click sounds common in various African languages such as Zulu. In time, however, such vocalizations take on the character of speech. From as early as 6 months of age infants from different language communities begin to babble somewhat distinctively, using some of the intonation of the language to which they have been exposed (Nakazima, 1962; Lieberman, 1967; Tonkova-Yampol'skaya, 1969). Research seems to indicate that in languages where the intonation contours are quite distinctive, native speakers can tell the difference between the babble of infants who were learning their (the native speakers') language as opposed to the babble of infants learning other languages (de Boysson-Bardies *et al.*, 1984).

The production of sounds using the intonation contours of the first language is obviously a learned phenomenon because when infants babble they follow the intonation contours of the language which they hear. This is something that deaf infants deprived of hearing speech do not do. While such infants are able to vocalize and cry, they do not progress to babbling. Interestingly, deaf infants who have been exposed to sign language from birth do the equivalent of babbling – *with their hands* (Petitto and Marentette, 1991)!

1.1.1.2 Babbling to speech

It is from the advanced stage of babbling that children move into uttering their first words. Often this occurs at around 1 year of age but can occur much earlier or much later. When children begin to utter words, somewhat surprisingly only some of the sounds that they have uttered in babbling appear in speech. The other sounds must be reacquired.

And there may be some order to the acquisition of speech sounds. For example, sounds like /x/ (as in Ba*ch*), /k/, and /l/ that commonly occurred in vocalization and babbling prior to speech may now tend to occur later, after the acquisition of such phoneme sounds as /p/, /t/, /m/, /a/ '*a*ll', and /o/ '*a*ll'. A phoneme, it should be said, represents a class of speech sounds in a language. For example, in the word 'pep' the individual sound /p/ can represent the sound at the beginning of the word '*p*ep' as well as the sound at the end of the word 'pe*p*'. (Incidentally, the letters surrounded by slashes (//) indicate that a phoneme sound is identified. A phoneme sound is a single discrete sound of a language.) Phonetically, the two sounds are different, with /p/ in the final position having a large amount of aspiration (puff of air). Nevertheless, they are regarded as the same phoneme. There is, then, some discontinuity between babbling and meaningful speech

where the kinds of sounds that occur in babbling are not always immediately realized in meaningful speech.

While some studies show some continuity between babbling and early speech (Vihman *et al.*, 1985), most research shows a lack of continuity, e.g. Oller and Eilers (1982), Stoel-Gammon and Cooper (1984), and Kent and Bauer (1985), in that advanced babbling seems to approach the consonant–vowel combinations of later meaningful speech. The relationship, however, is not a strong one.

Why is there some degree of discontinuity from babbling to the production of speech sounds? In our view, the discontinuity issue involves, as Jesperson (1933) noted many years ago, the distinction between intentional and non-intentional vocalization. Babbling is non-intentional in the sense that particular sounds are not under central cognitive control; the infant does not intentionally make the particular babbling sounds that occur. They seem to happen by the chance coordination of *speech articulators* (various parts of the body that are used to create speech sounds: mouth, lips, tongue, vocal cords, etc.). The case of meaningful speech is quite different. Here, sounds must not be uttered at random but must match previously heard sounds that are conventionally associated with certain objects, needs, and so forth. In order to accomplish this feat, it is necessary that the child discover which sound is created by which speech articulators. It is this knowledge that the child must acquire in order to speak meaningfully. Speech *is* dependent to some degree on babbling, however, for it is in engaging in babbling that the child will chance on many of the various articulatory mechanisms for producing speech and give practice to the use of those articulators.

1.1.1.3 Explaining the acquisition order of consonants and vowels

In the meaningful speech phase, it appears that consonants are acquired in a front-to-back order, where 'front' and 'back' refer to the origin of the articulation of the sound. Thus, /m/, /p/, /b/, /t/, and /d/ tend to precede /k/, and /x/. Conversely, vowels seem to be acquired in a back-to-front order, with /a/ (b*a*ll) and /o/ (t*a*ll) preceding /i/ (m*ee*t) and /ʌ/ (m*u*d). Jacobson (1968) devised a theory based on his distinctive feature theory of phonological oppositions that attempts to predict the order of the acquisition of speech sounds. In the main, however, empirical studies have not supported his predictions (Velten, 1943; Leopold, 1947; Braine, 1971; Ferguson and Garnica, 1975). There is much more variation in the order of acquisition than the theory predicts. Actually, this may well be expected, since there could be a great deal of chance involved when a child searches for the proper articulators of speech with which to make a sound.

As far as the establishment of intentional connections is concerned, our opinion is that two variables dominate this process: *visibility of articulators* and *ease of articulation* (first proposed by Steinberg, 1982). When the child becomes motivated to produce meaningful speech (this occurs after the

child has learned to understand some words spoken by other people), the child begins to seek ways to produce the desired sounds. The child then becomes alert to clues that relate to the articulation of the speech sounds.

The child observes where speech sounds come from and notes the relationship between the sounds and the position of noticeable speech articulators, particularly the mouth and lips (Kuhl and Meltzoff, 1988; Legerstee, 1990). It is mainly movements that the child observes and imitates. Since noticeable mouth and lip movements are primarily involved in the articulation of certain consonants, it is not surprising, therefore, that children tend to produce these consonants, such as /m/, /p/, and /b/, before the others. Consonant sounds like the stop /k/ and the fricatives /s/ and /z/, which involve the movement of non-visible articulators, are generally learned later.

As for vowels, since most involve the use of largely unseen articulators, children get little aid from direct observation. Rather, they must indulge in a lot of trial and error in order to secure the proper positions for articulators. It seems that those sounds that are closest to the resting position of articulators, e.g. back vowels such as /a/ (w*a*tch), are easier to create and are learned earlier while those sounds that require more motor control to create, e.g. a tensed front vowel such as /i/ (f*ee*t), are learned later.

However, over and above the operation of these variables of ease and visibility, there is (as first mentioned above) the important one of *chance*. It seems that children may discover by chance a particular articulator–sound connection, e.g. the daughter of Leopold (1953), Hildegard, was able to pronounce the word 'pretty' with precision yet she was unable to pronounce other words composed of similar sounds. Interestingly, although the word 'pretty' was pronounced accurately at first, over time, as her pronunciation of words developed, the pronunciation of that word deteriorated. It seems that if a word is to be retained, the chance discovery of an articulator–sound connection must be followed by its incorporation within the overall developing sound system.

1.1.2 Early speech stages: naming, holophrastic, telegraphic, morphemic

1.1.2.1 Naming: one-word utterances

When do children start to say their first words? It may surprise you to learn that research on this basic question is not at all conclusive. This is not only because there is a very wide range of individual differences but also because the precise determination of just when a word has been learned is not easy to make and is not standardized.

The mere uttering of speech sounds by the child, e.g. 'mama', may or may not indicate word knowledge. Children can be said to have learned

their first word when (1) they are able to utter a recognizable speech form, and when (2) this is done in conjunction with some object or event in the environment. The speech form may be imperfect, e.g. 'da' for 'daddy', and the associated meaning may be incorrect, e.g. all people are called 'da', but, as long as the child uses the speech form reliably, it may be concluded that the child has acquired some sort of word knowledge.

First words have been reported as appearing in children from as young as 4 months to as old as 18 months, or even older. On average, it would seem that children utter their first word around the age of 10 or 12 months. Some of this variability has to do with physical development, such as the musculature of the mouth, which is essential for the proper articulation of sounds. Certain brain development is also involved since the creation of speech sounds must come under the control of speech areas in the cerebral cortex (Bates *et al*., 1992).

It appears that children first use nouns as proper nouns to refer to specific objects (Moskowitz, 1978), after which they may or may not extend the meaning correctly for common nouns (Clark, 1973). For example, while 'dada' may first be used to identify one particular person, it may or may not be extended to include all men or all people. Or, 'wow-wow' may be used to refer to one dog, and then be extended to refer to all animals, soft slippers, or people in furs. In time, of course, the proper restrictions and extensions are learned.

1.1.2.2 Holophrastic function: one-word utterances

However, children do not only use single words to refer to objects; they also use single words to express complex thoughts that involve those objects. A young child who has lost its mother in a department store may cry out 'mama', meaning 'I want mama'. Or a child may point to a shoe and say 'mama', meaning 'The shoe belongs to mama'. Research has shown that the young child can express a variety of semantic functions and complex ideas by the use of single words (Bloom, 1973; Greenfield and Smith, 1976; Scollon, 1976). In such cases, the child uses a single word to express the thought for which mature speakers will use a whole sentence. It is because of this whole sentence function that this aspect of one-word speech is often referred to as 'holophrastic', where 'holo' indicates whole, and 'phras' indicates phrase or sentence.

Actually, it is quite remarkable how inventive children can be in the use of single words. Researchers have noted that children may describe a complex situation by using a series of single-word holophrases. For example, 'peach, Daddy, spoon' was used to describe a situation where Daddy had cut a piece of peach that was in a spoon (Bloom, 1973), and 'car, go, bus' was used to describe a situation in which hearing the sound of a car reminded the child that she had been on a bus the day before (Scollon, 1976). These strings of words are not yet sentences, because at the end of each

word the child pauses slightly and uses a falling intonation of the sort that is used by mature speakers to signal the completion of a sentence.

It is often not easy, of course, to interpret what a child is intending to convey by the single word. And, while knowing the child, the child's previous experiences, and elements of the present situation will serve to aid in the interpretation of an utterance, even the most attentive parents are frequently unable to interpret utterances that their children produce. Incidentally, we often use the traditional term 'utterance' rather than 'sentence' in order to avoid disputes as to whether what the child says is truly a sentence or whether it is grammatical. The advantage of the term 'utterance' is that it describes what the child says without having to worry about assigning sentencehood or grammaticality to what was said.

1.1.2.3 Telegraphic speech: two- and three-word utterances

Children do not proceed as rapidly to two-word utterances as one might expect. Why this should be the case is a matter of conjecture, although it is our view that children must first become aware that adding more words will improve communication, e.g. 'tummy hurt' is more effective than just 'hurt' or 'tummy'. In any case, around 2 years of age or so children begin to produce two- and three-word utterances.

Table 1.1 lists a number of typical two-word utterances along with what a mature speaker might say in the same circumstances. The possible purpose of each utterance is indicated, as are some of the semantic relations involved.

Variety of purposes and semantic relations

The most striking features about the dozen and a half or so very ordinary utterances shown here are the *variety of purposes* and the complexity of *semantic relations* that they exhibit. Regarding purpose, the child uses language to request, warn, name, refuse, brag, question, answer (in response to questions), and inform. In order to gain these ends, the utterances involve such semantic relations and concepts as agent, action, experiencer,[1] receiver, state, object, possession, location, attribution, equation, negation, and quantification.

Low incidence of function words

A second feature of the child's utterances is the low incidence of function words such as articles, prepositions, and the copula 'be'. Rather, it is nouns, verbs, and adjectives which mainly appear in the utterances. This is not surprising when one considers that these are the most informative classes of

[1] The term *experiencer* is used differently from many theorists here. We use it as indicating a sentient being that experiences states or ideas. A *receiver* is an experiencer who is affected by an action.

Table 1.1 Two-word child utterances and their semantic analysis

Child utterance	Mature speaker utterance	Purpose	Semantic relations (expressed or implied)
Want cookie	I want a cookie	Request	(Experiencer)–State–Object
More milk	I want some more milk	Request	(Experiencer)–State–Object; Quantification
Joe see	I (Joe) see you	Informing	Experiencer–State–(Object)
My cup	This is my cup	Warning	Possession
Mommy chair	This chair belongs to Mommy	Warning	Possession
Mommy chair	This chair belongs to Mommy	Answer to question	Possession
Mommy chair	Mommy is sitting in the chair	Answer to question	Location
Big boy	I am a big boy	Bragging	Attribution
Red car	That car is red	Naming	Attribution
That car	That is a car	Naming	Equation
No sleep	I don't want to go to sleep	Refusal	Experiencer–State–Negation
Not tired	I am not tired	Refusal	Experiencer–State–Negation
Where doll?	Where is the doll?	Question	Location
Truck table	The truck is on the table	Informing	Location
Daddy run	Daddy is running	Informing	Agent-Action
Joe push	I (Joe) pushed the cat	Informing	Agent–Action–(Object)
Push cat	I pushed the cat	Informing	(Agent)–Action–Object
Give candy	Give me the candy	Request	(Agent)–Action–Receiver–Object

words and would be the first that children would learn to understand. The meanings of function words, *to* John, *with* Mary, *the* car, candy *and* cake, could never be determined if the meanings of nouns, verbs, and adjectives were not known. Given knowledge of the words 'toy' and 'table', a child could guess what function a preposition like 'on' might signify when hearing the sentence 'The toy is *on* the table' in a situational context where a toy is 'on' a table. In other situations the idea 'under', for example, may be suggested.

Close approximation of the language's word order

The final feature of the child's utterances that should be noted is the close correspondence of the child's word order to that of proper sentences. The child learning English tends to say 'My cup' rather than 'Cup my', 'Not tired' rather than 'Tired not', and 'Daddy come' rather than 'Come Daddy' when describing the arrival of Daddy. Thus, even with two-word utterances, the child exhibits some learning of the word order of the language. This is not to say that the child does not produce significant deviations, nor is this a sufficient basis for claiming that the child realizes that different word orders signal different semantic relations. Yet it does show that the child has acquired a significant aspect of the grammar of English that will later enable the child to comprehend and produce appropriate utterances.

1.1.2.4 Morpheme acquisition

Once two- and three-word utterances have been acquired, children have something on which to elaborate. They start to add function words and inflections to their utterances. Function words like the *prepositions* 'in' and 'on', the *articles* 'the', 'a', and 'an', the *modals* 'can', and 'will', and the *auxiliaries* 'do', 'be', and 'have', begin to appear, together with *inflections* such as the plural /s/ on 'cats', and /z/ on 'dogs', and tense markings such as the /t/ past tense form on 'worked'.

A morpheme, it should be noted, is a root word or a part of a word that carries a meaning. Thus, for example, the single word 'elephants' consists of two morphemes, 'elephant' and Plural (s), as does the single word 'ran', which consists of 'run' and Past. Incidentally, 'elephants' consists of eight phonemes /e/, /l/, /ə/, /f/, /ð/, /n/, /t/, and /s/ (the symbol ə, schwa, represents a sort of reduced vowel). Clearly, the orthography often does not adequately represent actual speech sounds.

The Brown morpheme acquisition research

The most notable piece of research on morpheme acquisition to date is that done by the noted psycholinguist Roger Brown (1973). In a long-term and detailed study with three children, Brown focused on the acquisition of different function words and inflections in English. He found that children acquired the morphemes in a relatively similar order.

Brown's order of morpheme acquisition

Table 1.2 shows the list of morphemes and the general order in which they were acquired. Other studies have generally confirmed Brown's results. Even though other researchers have found some variation among children in terms of the speed in which they learned the morphemes, nonetheless the order was generally the same (Lahey *et al*., 1992). A similar acquisition order of these English morphemes has also been found for children with language disorders (Paul and Alforde, 1993).

Morphemes towards the top of the table are acquired before those towards the bottom. Thus, we see that Present Progressive,[2] Prepositions ('in' and 'on'), and the Plural were learned well in advance of morphemes like the Article, Third Person (Regular and Irregular), and the Auxiliary 'be'.

Why this order of acquisition?

That the morphemes should have been acquired in this order has been the subject of much speculation. Brown checked the frequency of occurrence of the morphemes in adult speech to see if more highly used morphemes were learned faster by the child. He found no relationship. He then considered that the order reflected an increasing order of semantic or grammatical complexity. For example, Plural is learned early because it only requires the idea of 'number', whereas the copula 'be' is more complex because the child needs to apply both number and tense to select which form of the copula to use (see Kess, 1992, p. 294). Undoubtedly, these are contributing factors. More contentious is the view of Dulay *et al.* (1982), who suggest that there is a sort of predetermined order in the child's mind that is governed by as yet *unknown* mechanisms, and that the morphemes appear in the order they do because of such mechanisms. We do not agree. A less metaphysical explanation is available.

Our explanation of the order of acquisition

Although it has been nearly three decades since Brown's theory of morpheme acquisition was first presented, no theory to date other than that of Steinberg (1982, 1993) and Steinberg *et al.* (2001) has adequately explained that order. The order of morpheme acquisition can be explained directly and simply by applying psychological learning principles, principles that are universal and accepted. As such, they will hold for children learning the grammatical morphemes of any language. The three variables that we posit to explain the general order of acquisition, according to the first author, are: (1) *Ease of observability of referent*, (2) *Meaningfulness of referent*, and (3) *Distinctiveness of*

[2] Regarding Brown's naming of the first morpheme acquired as Present Progressive, it should probably be termed simply Progressive because only the '-ing' suffix appears. However, the Present is implied in the child's utterance because the child usually talks about the here and now. The auxiliary 'be' that goes along with the Progressive does not appear until much later. It is for this reason that the Present is marked off with parentheses in Table 1.2.

Table 1.2 How psychological variables explain order of learning of morphemes

Morpheme name and concept	Examples	Learning variables					
		Observability of referent	Meaningfulness of referent	Sound signal for referent	Summary		
1. **(Present) Progressive**: continuing action	Mary playing	High	High	High	H	H	H
2. **Prepositions**: location	in, on	High	High	High	H	H	H
3. **Plural**: one vs. more than one object	/s/, /z/, /iz/	High	High	Low	H	H	L
4. **Past Irregular**: past time	came, went, sold	Low/Medium	High	High	L/M	H	H
5. **Possessive**: possession	/s/, /z/, /iz/	High	High	Low	H	H	L
6. **Copula 'be' Uncontractible**: connector with tense	What is it?	Low	Low	High	L	L	H
7. **Articles**: one; previous reference	a, an, the	Low	Medium	High	L	M	H
8. **Past Regular**: past time	/t/, /d/, /id/	Low/Medium	Medium	Low	L/M	M	L
9. **Third Person Regular**: third person present singular	/s/, /z/, /iz/	Low	Low	Low	L	L	L
10. **Third Person Irregular**	does, has	Low	Low	High	L	L	H
11. **Auxiliary 'be' Uncontractible**: tense carrier	Is Mary happy?	Low	Low	High	L	L	H
12. **Copula 'be' Contractible**: connector with tense	Mary's hungry	Low	Low	Low	L	L	L
13. **Auxiliary 'be' Contractible**: tense carrier	Mary's playing	Low	Low	Low	L	L	L

the sound signal that indicates the referent. The three variables are further based on the principle that generally what the child first understands will be that which the child first produces. These variables affect second-language learning as well.

- **Variable 1: Ease of observability of referent**. Whether an object, situation, or event is or is not easily observed by the child is essential for learning. The more easily a child can see or hear or otherwise experience the referent, e.g. seeing a dog, smelling a cookie, hearing a car, feeling hungry, the more likely are such referents – in conjunction with the speech sounds spoken by others – to be stored in memory. For example, if someone were to say 'The dog is barking' as opposed to 'The dog barked' or 'The dog will bark', the referent in the first sentence will be more saliently observable because it involves a present ongoing action, and this difference will affect learning.
- **Variable 2: Meaningfulness of referent**. Referent objects, situations, and events that are of interest to the child and about which the child desires to communicate will be learned faster than those that lack such interest. It is only natural that the child will remember the more highly meaningful referents.

  Child utterances reflect the concepts that the child wishes to communicate, e.g. 'Car table', 'Car going', 'Doll sitting', 'Doll walking'. When these highly meaningful items are compared to such grammatical function items as the Article, Auxiliary 'be', Copula 'is' with the auxiliary contractible 's, and Third Person marker, it is clear that function items have little inherent meaning for a child who is just beginning to learn the language. These are not, therefore, items that we would expect a child to learn quickly.
- **Variable 3: Distinctiveness of the sound signal that indicates the referent**. In order to learn a morpheme, besides the observability and meaningfulness of the referent, it is essential that the child be able to identify the speech sound that signals that morpheme. The greater the sound distinction involved, the easier it will be for a morpheme signal (consisting of one or more phonemes) to be learned. For example, compare the Incontractible Copula 'be' in 'What *is* it?' with the Auxiliary 'be' Contractible in 'Mary*'s* playing'. The former case with 'is' is more distinctive from a hearing point of view because it is a separate word with a vowel, and, as a separate word, it receives some degree of stress in a phrase or sentence. This gives prominence to the sound. In contrast, -'s is merely a consonant that is manifested as a suffix and does not receive stress.

Rating the morphemes on these variables

Let us rate the morphemes in the Brown study on each of these variables, assigning a value of High (H), Medium (M), or Low (L) depending on the degree to which we estimate the morpheme to manifest that variable.

Thus, for example, for the child's utterance of No. 1, 'Mary play*ing*', we assign a High on Observability (the continuing action is easy to see), a High on Meaningfulness (the whole event is of great interest to the child), and a High on Sound Signal because the '*-ing*' suffix is easy to distinguish ('play' vs. 'play*ing*') when the child hears this spoken.

Thus, in the Summary column this morpheme receives a H–H–H pattern. In contrast, for number 13, Auxiliary 'be' Contractible, we assign a Low on Observability because even without the -'s the child probably assumes that the '-ing' in 'playing' already implies present time in addition to continuing action. Until the child learns to understand and wants to express ideas of the past that involve a continuing action, like 'Mary *was* playing', the child will not be interested in such a morpheme. A Low is also given on Meaningfulness for the same reason. Since the -'s is barely discernible at the end of a noun, it is assigned a Low on Sound Signal. Thus, in the Summary column, this morpheme receives an L–L–L pattern.

Looking at the top of the Summary column, we see three Highs for number 1, (Present) Progressive, and number 2, Prepositions. As we proceed downwards in the order, the number of Highs decreases on the Observability and Meaningfulness variables; there is H–H–L for number 3, Plural, until at the bottom we see L–L–H for number 11, Uncontractible Auxiliary, and L–L–L for both number 12, Contracted Copula, and number 13, Contractible Auxiliary. Clearly, the more Highs there are for a morpheme, the faster is the learning, and, conversely, the more Lows, the slower the learning.

The data are remarkably uniform with respect to the postulated variables. This could hardly be otherwise, on reflection, *given the strong psychological drive that motivates the child in its search for meaning in speech*. Thus, morpheme referents that are more observable and carry more meaning will be more quickly learned than those that are not; this is why we find morphemes whose referents are less observable and less meaningful, generally the so-called grammatical function morphemes, towards the bottom of the list.

The morphemes in the top third of the table are undoubtedly qualitatively different from the morphemes in the bottom third of the table. The summary ratings reflect that intuition. This being the case, we can conclude that the three variables provide a good general explanation for the learning order of morphemes.

Explaining the order of some morphemes by the three variables theory

Let us now look in some detail at how the variables operate with one another so as to provide the learning outcomes that they do. In this regard, it will be instructive to consider three questions on morpheme acquisition order that highlight the operation of these variables. They are: (1) Why are Progressive and Prepositions 'in' and 'on' learned earliest?; (2) Why is Plural

and Possessive learned before Third Person?; (3) Why is Past Irregular learned before Past Regular?

1. **Why are the Progressive and Prepositions 'in' and 'on' learned earliest**? Objects in the child's world are of great importance to the child. The Progressive (continuing action) morpheme involves the *action* of those objects, while prepositions involve the physical *location* of those objects. The Progressive morpheme relates to the action of objects, where the action continues through present time. A cat jumping, a car moving, a baby crying, for example, all involve objects in action. A mother says, 'The dog is barking' or 'The car is coming'. The events that interest the child stimulate the child's interest in what the mother is saying.

   However, not all verbs are used with -ing at the same time. The Progressive tends to appear first on verbs involving durative, non-completed, events such as 'play' and 'hold' (Bloom *et al.*, 1980). This would serve to increase the meaningfulness of the Progressive morpheme, since durative action would tie in with the meaningfulness of the words that the child has learned; these are usually associated with *continuing* events such as 'playing' or 'running'. The Progressive is used on non-durative verbs such as 'break' and 'spill' later in the child's speech development.

   Not only are children interested in the actions of objects, they are interested in their location as well. The prepositions 'in' and 'on' are highly meaningful because they signal the locations of objects, objects which are important in terms of meaning and communication, e.g. 'Doll *on* box' as opposed to 'Doll *in* box'. The prepositions 'in' and 'on' are learned prior to other prepositions for two reasons. (1) They are linearly sandwiched between two concrete nouns (e.g. *'doll* in *box'*), the referents of which are meaningful and easily observable in the physical environment. (2) The referents remain stationary in physical space with respect to one another, thus allowing for ease of observability. Such clearly observable object-plus-object relations make these particular prepositions relatively easy to learn. On the other hand, other prepositions such as 'to', 'at', and 'with' often involve more complex semantic constructions, e.g. Action + Relation (preposition) + Object: 'walk to the school', 'stand at the door', 'go with Daddy'. The greater the semantic complexity, the slower will be the learning (all other things being equal).
2. **Why are Plural and Possessive learned before Third Person**? Since all three regular morphemes of the Plural, Possessive, and Third Person Singular are suffixes that have exactly the same sound forms, for example, 'dog/z/' (Plural), 'Bob/z/' (Poss.), and 'sing/z/' (Third Person), all end with /z/. In fact, the three forms of each suffix for each of these three morphemes are exactly the same, /s/, /z/, and /iz/. The selection of these suffixes is governed by the same sound conditions (the final sound of the word). Since the three different morphemes have exactly the same sound

pattern characteristics, the reason for their differential acquisition order must be due to factors *other than* their sounds, these factors are Observability and Meaningfulness.

The Plural and Possessive are much more involved with observable and meaningful referents for the child than the Third Person Singular. These two morphemes involve physical events, situations, and objects that are readily observed in the environment, e.g. for the Plural the child can easily distinguish one cookie versus two cookies and one cat versus two or more cats, while, for the Possessive, the child can easily distinguish his or her toys from another child's toys. Thus these are morphemes whose referents are easily noticeable and, in addition, involve referents that are highly meaningful to the child.

The Third Person morpheme, on the other hand, involves the noting of a singular Third Person referent, a much less obvious kind of object, being defined by a more abstract relationship. The child typically must pick up the use of the abstract first and second person (speaker–listener) relationship (I and You) before making the Other (non-speaker, non-hearer) distinction. We call this an 'abstract' relationship because the 'I' changes on the basis of who is speaking, and the 'You' changes according to who is listening. The Person role is more abstract than the unchanging concrete objects that are named in the Plural and the Possessive.

3. **Why is Past Irregular learned before Past Regular**? Since the idea of past is involved with both the Past Irregular and Regular forms, the explanation for the order of acquisition of these two types of past forms must lie other than in Observability, i.e. noting that a certain sound indicates that what is being said concerns an event that occurred in the past. That leaves the other two variables: Meaningfulness and Sound Signal. Before we focus on these variables, it will be instructive to compare the verb forms of the present tense with those of the past, for both Irregular and Regular verbs:

   Irregular in Present/Past: c*o*me/c*a*me, *go*/*went*, *eat*/*ate*, br*ea*k/br*o*ke, f*a*ll/f*e*ll, r*u*n/r*a*n, s*i*ng/s*a*ng
   Regular in Present/Past: jump/jump*ed*, jog/jogg*ed*, want/want*ed*

   If one says these pairs aloud it will be obvious that the sound changes from Present to Past are much more noticeable for the irregular verbs than for the regular ones. The sound suffixes of the Regular Past forms are /t/ (jump*ed*), /d/ (jogg*ed*), and /id/ (want*ed*), with the first two (/t/ and /d/) being especially hard to hear. Since a sound difference must first be noticed and brought to attention before it can be learned, we would expect the very noticeable irregular forms to be learned faster, and that is the case. So, the Sound Signal is a crucial variable here.

   However, meaningfulness is also at work here because, although the regular verbs are more numerous, the irregular verbs tend to be highly important ones in everyday life. These are the so-called 'strong' verbs of

English. This extra meaningfulness gives the irregular forms an additional boost in the process of learning, which is why in Table 1.2 the Past Irregular is given a High on Meaningfulness but the Past Regular is only given a Medium. But this is not the whole story. Because the irregular verbs are the most common ones in everyday life, they tend to occur more frequently (as individuals) than the regular verbs. This *higher frequency of occurrence* of irregular verbs would also serve to make these verbs easier to learn.

From the examples given above, it is clear that the three common psychological learning variables of Referent Observability, Referent Meaningfulness, and distinctiveness of Sound Signal go far in explaining the learning of various morphemes and the order in which they are learned. Frequency of occurrence operates too but only within the confines of the three determining variables.

1.1.3 Later speech stages: rule formation for negatives and other complex structures

With the production of longer utterances, simple structures are elaborated to yield more complex ones. Negative sentences, question forms, passives, and relative clauses are just a few of the many complex rules that children acquire in their first five years. (Rules are used here in a general sense and may be interpreted as principles, parameters, limits, etc. Chomskyan theory is by no means necessarily implied by the use of these terms.) Although many other rules are also being acquired, we will select for consideration the complex rules used in forming negations, questions, relative clauses, and passives. Since this is the general order of acquisition of structures, we will use this order in presenting these constructions. It should be borne in mind, however, that the learning of some of these constructions sometimes overlaps, such as in the case of negation and question, which share a number of grammatical features.

1.1.3.1 Negation formation

Negation development

Before presenting some of the acquisition data concerning negation, it may be useful to review some of the features of the negation process.

Let us consider some sentences and their negations.

1a.	Affirmative:	Kim is hungry.
1b.	Negative:	Kim is not hungry.
1c.	Negative Contraction:	Kim isn't hungry.
2a.	Affirmative:	Kim wanted some candy.
2b.	Negative:	Kim did not want any candy.
2c.	Negative Contraction:	Kim didn't want any candy.

Features of negation

In learning to produce these negations, the child must learn a number of different things. In considering these features, let us make negative the affirmative sentence of:

Kim wanted some candy.

1. Where to *insert the negative marker*.
   (a) If the verb is 'be', then NEG is placed *after* the Copula 'be' form. Thus, 'Kim is NEG happy' becomes 'Kim is not happy'.
   (b) If the verb is not 'be', then 'not' is placed *before* the verb. Thus,

   Kim not want + PAST some candy.

2. When and where to *insert auxiliary 'do'*.
   Insert 'do' when the verb is one other than 'be' ('have' is a special verb, e.g. 'Kim did not have any money' and 'Kim had no money', which will not be considered here). Thus, we get

   Kim do not want + PAST some candy.

   'Do' is not inserted if there is a modal (will, can) or auxiliary (be, have) present, as in 'Kim *will not want* to go'.
3. When auxiliary 'do' is used, then *the tense from the verb is shifted to the auxiliary 'do'*. Thus, from 'Kim do not want + PAST . . .', we get

   Kim do + PAST not want some candy.

   Then, lexicalization (the asterisk here and elsewhere indicates ungrammaticality):

   * Kim did not want some candy.

4. In English, *Lexical Concordances* must be made in the case of the negative, e.g. 'some' must change to 'any' so as to yield the grammatical

   Kim did not want any candy.

5. Optionally, AUX + NEG ('did' + 'not') can be *contracted* to 'didn't'. This would provide us with

   Kim didn't want any candy.

The above features of negation must be taken into account by any theory of grammar. While in the above example, for simplicity's sake, operations were applied to an affirmative *sentence*, a semantic or conceptual representation of such a sentence can (and should) be the point of origin. Negation features therefore may include meaning terms. The surface string of words must be the same whatever theory of grammar is being considered, as must be the features of negation.

Negation is one of the earliest sentence structure rules acquired by children. According to the classic research of Klima and Bellugi (1966) and others

who later replicated their work, there is a consistent pattern in this, with negation being acquired in three main periods. Sample sentences and their analysis follow below for each period. Incidentally, these data are taken from the same three children whose morpheme acquisition was described above in the Brown study.

Period 1

> 'No money'; 'Not a teddy bear'; 'No play that'; 'No fall'; 'No the sun shining'; 'No singing song'

In this, the earliest period, a negation marker (NEG), in the form of 'no' or 'not', is placed at the front of an affirmative utterance (U). Thus we see utterances typically of the form, Neg + U ('No fall'). Children everywhere seem to use much the same pattern in early acquisition of negation. French children place *non* or *pas* before U (Grégoire, 1937), while Japanese children place the Japanese negative marker *nai* after the U (U + Neg) in accordance with the structure of their language (McNeill and McNeill, 1968).

Period 2

> 'I don't want it'; 'I don't know his name'; 'We can't talk'; 'You can't dance'; 'Book say no'; 'Touch the snow no'; 'That no Mommy'; 'There no squirrels'; 'He no bite you'; 'I no want envelope'

In this second period, the negative marker tends to appear internally within the utterance rather than outside it as in the previous period, and the auxiliaries 'do' and 'can' appear with the negation marker. Klima and Bellugi believe that children treat 'don't' and 'can't' as single words and do not analyze them as Aux + Neg. That the uncontracted forms of 'do' and 'can' do not appear in the data is one telling argument that they present in support of their view. Utterances are still of a rather crude nature, though, and negative imperatives, 'Touch the snow no' ('Don't touch the snow'), are as poorly formed as they were in the previous period ('No play that' ('Don't play with that'), 'No fall' ('Don't fall', in one interpretation)).

Period 3

> 'Paul can't have one'; 'This can't stick'; 'I didn't did it'; 'You didn't caught me'; 'Cause he won't talk'; 'Donna won't let go'; 'I am not a doctor'; 'This not ice cream'; 'Paul not tired'; 'I not hurt him'; 'I not see you anymore'; 'Don't touch the fish'; 'Don't kick my box'

In this third period, the period before which perfect negatives are formed, the Copula 'be' ('am not') and the modal 'will' ('won't') appear with negation and imperative negatives are formed with 'do' rather than the simple negative ('Don't touch the fish' as opposed to 'Touch the snow no' in earlier periods). The child now has a good idea of when 'do' must be inserted

('You didn't caught me', 'I didn't did it', 'Don't kick my box') and when 'do' is not inserted ('I am not a doctor', 'Donna won't let go'). The child still makes errors but seems to grasp the basic notion that 'do' is not added when there is a modal ('can', 'will': 'This can't stick [adhere?]', 'Donna won't let go') or when 'be' is the verb ('I am not a doctor'). The children's mastery of negation at this period is nearly complete. Only a number of relatively minor problems, such as the re-assignment of tense from Verb to AUX ('You didn't caught me', 'I didn't did it'), remain to be resolved.

After this period, in a matter of months or a year, most of the problems in negative marking are successfully dealt with, although children may make occasional mistakes for years after. (The first author recently observed such occasional errors in the speech of his 5-year-old son along with errors in other morphemes involving exceptions. See Steinberg *et al.* (2001) for a consideration of their learning of other complex syntactic structures).

1.2 The development of speech comprehension

Thus far, we have been focusing on the child's development of *speech production*. Now we would like to focus on the child's development of *speech comprehension*. When, for example, does the understanding of speech begin and how does it relate to production?

1.2.1 Fetuses and speech input

Before dealing with newborns, let us look at research that is concerned with stimulating language development even *before* the child is born. Can speech sounds reach the fetus while it is still in the uterus? Benzaquen *et al.* (1990) put a microphone inside the uterus of a pregnant woman to see if speech sounds could reach the ear of the fetus over the background sounds of the women's heartbeat and blood flow. The mother's speech sounds *were* found to be able to reach the ear of the fetus above the background sounds. However, whether the ear of the fetus is developed enough to send such significant sounds to the brain is in dispute.

In another study where loudspeakers were placed next to pregnant women, two experimental groups were presented with sound sequences in different orders: one group was exposed to /babi/ + /biba/ while the other received the reverse order /biba/ + /babi/ (Lecanuet *et al.*, 1989). Later, after a number of presentations, the two sound sequences were played in varying orders to both groups of women and measurements were taken. Measurements of the fetuses' heart rates showed a differential effect for the two groups during the testing period. The heart rate of the fetus was higher when the sequence they were trained on was played. The effects of the mother's voice on the fetus's intrauterine listening thus may explain post-birth listening

preferences of the neonate (newborn baby) for the mother's voice and for the language the mother spoke while pregnant.

DeCasper and Fifer (1980) recorded mothers reading a story to their newborns. Then their 3-*day*-or-younger infants were given a pacifier connected to a computer that would play recordings of the mother's voice or of another woman's voice. A high rate of sucking on the pacifier would activate the playing of a mother's voice. Comparing changes on the sucking rate with the infant's baseline rate, the researchers found that the infants sucked more in order to activate the tape with their mother's voice than to hear the voice of another woman!

The requirement was then changed so that the infants had to suck at a *lower* rate than normal in order to hear their mother's voice. The infants quickly changed to slower rates, thus demonstrating that they could distinguish the sound of their mother's voice and that of another woman. Locke (1993), however, suggests that the learning of the mother's voice may actually have occurred, not prenatally, but within the first 12 hours after birth when the mother was talking to the newborn. Since the measurements were taken after the 12-hour period, this could well be the case. If so, then there may not have been any prenatal learning.

It is worth mentioning that even if a fetus could hear sounds from the outside world, those sounds would have to be through the medium of a liquid in the fetal sac. That being the case, *speech* sounds are difficult to distinguish. How much, for example, in terms of speech sounds, can one hear when one is underwater in a pool? General sounds are all that come through. While this may be enough of a basis for a fetus later to distinguish among different voices according to pitch or loudness, it is certainly insufficient for identifying speech sounds.

1.2.2 Speech comprehension occurs *without* speech production: the case of mute-hearing children

While the ability to utter speech in appropriate situations is a good indicator of language knowledge, the absence of the ability to produce speech may *not* indicate a lack of language knowledge. There are many hearing persons who are born mute. People may be born with cerebral palsy or some other abnormality that prohibits them from articulating speech. Yet such persons may learn to comprehend all that is spoken to them. Let us consider some actual cases here so as to better understand this important phenomenon. Following this we shall consider the development of speech comprehension in normal children, which, we shall see, also relates to this phenomenon.

Christopher Nolan

Christopher Nolan is an Irish writer of some renown in the English language. Brain-damaged since birth, Nolan has had little control over the

muscles of his body, even to the extent of having difficulty in swallowing food. He had to be strapped to his wheelchair because he could not sit up by himself. Nolan cannot utter recognizable speech sounds.

Fortunately, though, his brain-damage was such that Nolan's intelligence was unimpaired and his hearing was normal; as a result he learned to understand speech as a young child. It was only many years later, though, after he had reached 10 years, and after he had learned to read, that he was given a means to express his first words. He did this by using a stick that was attached to his head to point to letters. It was in this 'unicorn' manner, letter by letter, that he produced an entire book of poems and short stories, *Dam-burst of Dreams* (Nolan, 1981), while still a teenager (he was born in 1965). This was followed some years later by an autobiographical book, *Under the Eye of the Clock* (Nolan, 1988), also written in the letter-by-letter mode. Nolan's writing is of such quality that it has been compared to the works of Yeats and Joyce.

Anne McDonald

The first author came across another case similar to Nolan's while reading *The New Yorker* magazine. It was that of Anne McDonald (Specter, 1999), another remarkable person. She was born in Australia in 1961. Due to brain-damage during birth McDonald has never been able to control her muscles and speech articulators. Her hearing has always been fine though. Like Nolan she too had to be strapped to a wheelchair; she uses an elaborate computer device on her lap for issuing recorded messages.

At 16 years of age McDonald weighed only 28 pounds (about 13 kg), but it was at that time that her life changed. Friends took her to an art gallery, where for the first time she discovered art and was 'transfixed by the Matisses', her friend said. Despite her handicaps, this woman was motivated to study the Philosophy of Science and Fine Arts at the University of Melbourne. She later published a book and continues to write by the use of print devices.

Rie

Rie was a little Japanese girl whom the first author had the opportunity to study while he was a visiting professor at Hiroshima University. From birth Rie was mute, except for being able to utter two weakly whispered sounds, roughly /i/ and /a/. Such sounds were not used in any communicative fashion. In contrast to the conditions of Nolan and McDonald, however, Rie's other motor skills appeared normal. She could run and jump and, when the first author met her at the age of 3 years, could even ride a tricycle. While Rie probably had some sort of brain damage to the motor area of speech, the exact cause of her muteness was not known.

On being tested for her ability to comprehend speech, Rie could respond appropriately to such complex commands (in Japanese) as 'Put the red

paper under the table' and 'Bring me the little doll from the other room'. Her level of speech comprehension was similar to that of other 3-year-olds. She was even able to learn basic reading by comprehending 100 different *kanji* (Steinberg and Chen, 1980).

Clearly, like Nolan, Rie learned to comprehend speech and even to read in the absence of any ability to produce speech.

Conclusion

Persons who are mute but hearing can develop the ability to comprehend speech *without* their being able to produce speech, so long as their basic intelligence is intact. But how are such people able to comprehend the sentences that they do, given that such sentences reflect the essential characteristics of language, i.e. comprehension of an unlimited number of novel grammatical sentences, recognition of synonymy, of ambiguity, etc.? The answer must be that these mute persons developed a grammar, *a mental grammar based on speech comprehension*; that enabled them to understand the speech to which they were exposed! This is the same grammar that normal children develop.

1.2.3 In normal children speech comprehension develops in advance of speech production

That children are unable to utter words or sentences for the purpose of communication without first gaining an understanding of speech could hardly be otherwise. If children did not first learn to understand the meaning of words and sentences, they would not be able to use words or sentences in a meaningful way. They observe what others say and how what is said relates to objects, situations, and events.

To say that comprehension of a language necessarily precedes production does not mean a child must understand all of the language before being able to produce something. Rather, progress goes bit by bit. As the comprehension of some word, phrase, or grammatical form is learned, some of that learning may be produced in speech (Ingram, 1974). That speech understanding always precedes production is the pattern that continues throughout the acquisition process (Ingram, 1989) whether it be for first words (Clark and Barron, 1988), elaborate syntax such as passives (Golinkoff and Hirsch-Pasek, 1995), or the later acquisition of idioms and figurative speech (Levorato and Cacciari, 1995).

It should also be noted that the two systems of comprehension and production do not develop separately for the normal child. As the child acquires an aspect of grammar for comprehension, the child will then try to figure out how to use it in production. Thus, the child attempts to coordinate production to conform to the system that the child has developed for comprehension (Clark and Hecht, 1983).

Pre-speech normal infants

Babies can recognize words as early as 6 months of age. Tincoff and Jusczyk (1999) had 6-month-old babies watch two TV monitors, one with a picture of the baby's mother and the other with a picture of the baby's father. While being held, and facing one of the images on the TV, a synthesized voice said 'mommy' or 'daddy'. After a number of presentations of voice and picture, the baby then heard the voice say one of the words. More often than by chance, the baby would turn to look at the picture being named. Thus, when the voice said 'mommy' the child would look at the video image of the mother, and when the voice said 'daddy' the child would look at the video image of the father.

Understanding at 6 months is earlier than most researchers had previously supposed. As Tincoff and Jusczyk note, 'Most of the previous work on comprehension indicated it was eight or ten months of age when kids started to attach language labels to particular objects.' Whatever the case, it is clear that the *comprehension and production processes develop in a parallel mode with production always trying to keep up with comprehension*.

1.2.4 Speech production lags behind speech comprehension

1.2.4.1 The Huttenlocher study

Huttenlocher (1974) studied four young children, aged 10 to 13 months, over a six-month period and found that they were able to comprehend speech at a level beyond that to which they had progressed in production. The children were able to select familiar objects such as 'bottle' or 'diaper' that were named for them and were able to respond appropriately to commands even though they did not use such words and structures in their own speech. One boy, for example, responded appropriately to such distinctions as 'baby's diaper' and 'your diaper', and 'baby's' bottle' and 'your bottle' (the 'baby' referred to here is the boy's younger sister). Even if, as Ingram (1989) notes, a scrambled word order should also have been tested, this would not change the interpretation of the outcome. For it is a fact the boy did give appropriate responses to combinations, combinations that involved complex possessive distinctions that he himself had never used in speech.

1.2.4.2 The Sachs and Truswell study

In another important study, Sachs and Truswell (1978) found that children who could only produce single-word utterances (they were at the one-word stage of speech production) nevertheless could comprehend syntactic structures composed of *more than one word*. Words for the testing were selected from the children's own productions, e.g. the verbs 'kiss' and 'smell' and the nouns 'ball' and 'truck'. These words were placed together in novel

combinations in the imperative form, for example, 'Kiss ball' and 'Smell truck'. The children did what they were told: they kissed the ball and smelled the truck! Obviously the children's level of speech comprehension was well in advance of their level of speech production.

1.2.4.3 A Reading before Speaking study

Parents have always noted that children are able to understand more than what the children are able to say. Steinberg and Steinberg (1975) went one further. They taught their son to read (understand the meaning of) many written words, phrases, and sentences even before he was able to say them. Thus, he was able to respond appropriately to words and sentences, e.g. 'Open the door,' whether they were in speech or in writing and *even when he himself did not say those words*. The items that he had been taught to read were only those items that he could comprehend when such items were spoken to him. Later he was able to comprehend novel combinations of those written items.

1.2.5 Relative paucity of comprehension studies

Unfortunately, although speech comprehension plays a crucial role in language acquisition, comparatively few studies have been devoted to its investigation. Most of the language acquisition studies have been concerned with the development of speech production. The reason for this is simple: production studies are easier to do. The product of the speech production process, the child's utterance, is something that can be directly observed while the product of the comprehension process, meaning, cannot. Comprehension can only be inferred on the basis of relevant behaviour. Needless to say, this is very difficult.

1.3 The relationship of speech production, speech comprehension, and thought

1.3.1 Speech comprehension necessarily precedes speech production

In learning any of the world's languages, children must first be able to comprehend the meaning of the language before they themselves can produce it. Though children may at times appear to speak an occasional word or phrase intelligibly, these are usually instances of echoed sounds spoken without knowledge of their meaning. The basis of all language is meaning, and without having had the opportunity to hear and understand words, phrases, and sentences within meaningful contexts, children could not begin to produce language meaningfully.

Children first need to be exposed to utterances with a clear connection to the articles referred to before they themselves can begin to say such utterances. Since children are not born with the knowledge of any particular language, e.g. English or Chinese, it is necessary that they be exposed to a language in order to learn it. However, simple exposure is not enough for language acquisition to occur. It is also necessary that the speech to which children are exposed be related to objects, events, and situations in their physical environment, and to subjective events in their minds such as pain, hunger, desire. Children will not learn language if all that they are exposed to is speech sound, no matter how many times it is uttered. Thus, for example, even if one heard the speech sound /neko/ a hundred times, one would have no way of knowing that it means 'cat' (in Japanese) unless there was some environmental clue.

Children may sometimes repeat words or phrases they hear, but this is not evidence for learning unless the sounds are used in a meaningful context that is suitable for those sound forms. Only when speech sounds are used appropriately in situations is there a basis for imputing language knowledge to the utterer. There are birds, for example, that can imitate the words of the language very clearly but generally they cannot do so in a meaningful context.

Speech comprehension precedes and is the basis of speech production. How could it be the other way? It is unimaginable for a person to have the ability to produce speech without having the ability to comprehend speech (or any other physical mode of expression – sign, touch, writing). While we know of people who can comprehend speech without being able to produce it (the cases of Nolan, Rie, etc. above), the reverse situation does not exist. This is *necessarily* so and could not be otherwise for two reasons: (1) A learner must first hear speech sounds before the person knows what sounds to make, and (2) A learner must hear the speech sounds in coordination with the experience of objects, situations, or events in the environment or the mind before the person can assign a meaning to the speech sounds.

1.3.2 Thought as the basis of speech comprehension

The meanings that underlie speech comprehension are concepts that are in a person's mind. Speech does not provide such concepts. Speech sounds initially are simply sounds signifying nothing. The contents of thought are provided by the child's *experience of the environment*, i.e. dogs, cats, people, food, and events concerning those objects, and the child's *experience of its own feelings, emotions, desires, and conceptual constructions (thoughts)*. Without such contents of thought, the child would have nothing to assign as the meanings of words and sentences. Thought necessarily precedes language. For example, while we can find cases of persons who have no language (deaf people and children raised in isolation without language: Chapters 2 and 4), we cannot find cases of persons who have language but no thought. Language is a

system that allows for the labelling of thoughts in terms of physical sound so that the thoughts may be communicated to others. Thought, however, is independent of language, including as it does ideas, feelings, percepts, emotions, etc. (see Chapter 9 for details). As such, thought provides the basis for speech comprehension, which in turn provides the basis for speech production.

In learning the meaning of syntactic structures, simply hearing the speech sounds 'John chased Bill', and knowing the meanings of the individual words 'John', 'chased', and 'Bill' is insufficient information for determining who is doing the chasing and who is being chased. One must hear sentences in conjunction with related events in the world in order to learn that English has an Agent–Action–Object sequence. Thus, by hearing the sentence 'John chased Bill' along with an experience of the event of John having just chased Bill, the child is provided with a basis for learning that it was 'John' who did the chasing and that it was 'Bill' who was being chased.

1.4 Parentese and Baby Talk

1.4.1 Parentese

During the 1960s, Chomsky's theorizing about innate language knowledge had a dampening effect on the study of experiential input, both language and environmental, with respect to the learning of language. A sort of mystical aura dominated the field. Language was not 'learned' but somehow mysteriously 'acquired'. Research has since shown, however, that the nature of the speech and environmental input which children receive is essential for language learning. For example, children who have the misfortune to have been exposed to limited and impersonal language such as through television or by overhearing adults' conversations do not acquire significant language knowledge (Todd, 1972; Snow *et al.*, 1976).

Parentese (coined by the first author in Steinberg, 1993, p. 22) is the sort of speech that children receive when they are young. Parentese is also referred to as 'Motherese', 'caregiver speech', 'Adult-to-Child Language' (ACL) (Reich, 1986), and as 'Child-Directed Speech' (CDS) (Pine, 1994). All of these terms take into consideration the fact that the child receives input from many sources – mother, father, siblings, relatives, friends, etc. (Nwokah, 1987; Bavin, 1992) – and that such input has special linguistic characteristics.

1.4.2 Characteristics of Parentese

Immediacy and concreteness

The speech that parents and others use in talking to children has a number of distinctive characteristics that evidently aid language learning. For example,

parents generally talk to their children about what is happening in the immediate environment and not about abstract or remote objects and events (Phillips, 1973; Slobin, 1975). A sentence like 'The dog wants water' and not 'Speech comprehension precedes speech production in language learning' is what a 1- or 2-year-old is likely to hear even from these two authors!

Grammaticality of input

Generally, the speech directed to children is highly grammatical and simplified. Ungrammatical sentences are found to occur but rarely. Newport (1975, 1976), for example, in a long-term study with 15 mothers, reports an incidence of only one ungrammatical utterance in 1500 in their speech. Such grammatical consistency undoubtedly is useful to the child who is searching to discover the structures that underlie sentences. These research findings are not perhaps surprising, and they lend evidence against Chomsky's claim that children learn language despite being exposed to a high proportion of 'degenerate' sentences (Chomsky, 1967b).

Short sentences and simple structures

Speech directed to children by adults also tends to consist of short sentences with simple rather than complex structures (Snow, 1972; Seitz and Stewart, 1975; Garnica, 1977a), such as 'The dog wants water' as opposed to 'The dog which has been running a lot wants to drink some water'.

Vocabulary: simple and short

The vocabulary typically used by adults is simple and restricted (Phillips, 1973; Seitz and Stewart, 1975), e.g. 'see' instead of 'notice', 'hard' rather than 'difficult', and has simplified phonology and structure (Ferguson, 1964, 1977; DePaulo and Bonvillian, 1978). For example, consonant plus vowel word patterns such as 'mama', 'wawa', and 'byebye' are used rather than the more complex sound patterns of 'mother', 'water', and 'goodbye'.

Exaggerated intonation, pitch, and stress

Furthermore, adults exaggerate intonation and use a slower tempo (Drach, 1969; Cross, 1977; Garnica, 1977b), and frequently repeat or rephrase what they or their children say (Brown and Bellugi, 1964; Kobashigawa, 1969; Snow, 1972; Newport, 1975). For example, adults tend to use higher pitch, slower speech, with more and clearer pauses between utterances, and they place more distinctive stress on words than they do when speaking with other adults. Additionally, adult speech to children refers more to the context of the conversation (Snow, 1972; Phillips, 1973), and often serves to clarify the children's utterances (Cross, 1977). These changes will vary depending on the age of the child the adult is talking to (Snow, 1972; Garnica, 1977b); the speech addressed to 2-year-olds will be different in modifications from that addressed to 10-year-olds.

Older children, too, adapt their speech

It is interesting that not only adults but children, too, tend to use simplified speech in talking with younger children. For example, 4-year-old children produced simplified speech when talking to 2-year-olds but not when talking to adults, even though some of the 4-year-olds did not have younger siblings (Shatz and Gelman, 1973). It seems, too, non-parents also simplify speech (Sachs *et al*., 1976). The simplification of speech may well be a universal phenomenon (Blount, 1972; Snow *et al*., 1976).

1.4.3 Baby Talk

Baby Talk is a form of Parentese but with its own characteristics. While Parentese uses vocabulary and syntax, though simpler than that addressed to other adults, Baby Talk involves the use of vocabulary and syntax that is *overly* simplified and reduced. Curious, though, from a psycholinguistic view, is the fact that most of the features that Baby Talk adopts are those that have their basis in the early speech of children. Parents and others evidently believe that those features, when reintroduced back to the child, serve to foster communication. However, it should be remembered that Baby Talk is something that parents learn from other adults and involves standardized vocabulary. It is 'standard' in the sense that such vocabulary is culturally transmitted over generations.

Vocabulary

Most Baby Talk involves modifications in vocabulary. There are already established words like 'bow-wow' (dog), 'pee-pee' (urine), and 'choo-choo' (train) in English and, in Japanese, 'wan-wan' (dog: the standard word for which is *inu*), 'shee-shee' (urine: the standard word is *nyoh*), and 'bu-bu' (car: the standard words for which are *jidosha* or *kuruma*). From such examples, we can see that the main sound structure of such words tends to be dominated by a Consonant + Vowel syllable unit that is often repeated (reduplicated). Sometimes it involves a closed syllable as in 'wan-wan'. Thus, the sound structure of Baby Talk words, [C + V + (C)] × N (where N can be any number, but, usually, 1 or 2), is common to languages around the world.

Another construction principle for many Baby Talk words is that they are supposed to represent the sounds that various things make, i.e. they are onomatopoeic. Thus, English 'bow-wow' and Japanese 'wan-wan' are apparently simulations of the barking of dogs, Japanese 'bu-bu' is supposed to be the sound made by a car engine, and English 'choo-choo' the sound made by a train. The fact that such a sound as 'choo-choo' in English is meant to approximate to the largely extinct steam locomotive bothers neither parent nor child. Here the word has become an entry in the standard Baby Talk vocabulary.

Syntax

Syntax plays a less prominent role in Baby Talk than does vocabulary. Parents seem only occasionally to use standard syntax in Baby Talk. When they do, their utterances are strikingly similar to those in the children's telegraphic stage of speech production, with the focus being on word order. A mother might say, for example, something like 'Mommy give Tony banana' instead of the syntactically proper 'I will give you a banana'. In such an utterance, neither the modal 'will' nor the article 'a' has been included. And the names 'Mommy' and 'Tony' have been substituted for the more difficult personal pronouns 'I' and 'you'. Substituting proper names for personal pronouns is a common feature of Baby Talk that is not usually found in speech between adults (Elliot, 1981). Certainly, fixed proper nouns are easier for the young child to understand than are items involving shifting speaker–listener relations. It is later that the child learns to cope with the speaker–listener complexities of 'I' and 'you'. Such proper name substitutions, it should be noted, also occur in Parentese and thus are not solely features of Baby Talk.

1.4.4 The effect of Parentese and Baby Talk in language learning

Do Parentese and Baby Talk facilitate language learning? The studies done on these questions demonstrate a positive but small effect (Newport *et al*., 1977; Furrow *et al*., 1979; Kemler-Nelson *et al*., 1989; Murray *et al*., 1990). Other research also provides evidence that Parentese may be effective but only for children who are very young (Gleitman *et al*., 1984). It seems to us that the fact that Parentese and Baby Talk occur gives strong weight to the notion that they are beneficial.

1.5 Imitation, rule learning, and correction

1.5.1 What is learned by imitation

Many people believe that language is learned by imitation. By imitation it is meant that the child copies and repeats aloud the words that he or she hears. Through imitation, children learn how to pronounce sounds and words and they seem to enjoy imitating the sounds that they hear (Masur, 1995). All this is fine. However, it must be kept in mind that there is an obvious limitation, which is that *imitation can apply only to speech production and not to speech comprehension*. Since we know that speech comprehension precedes speech production, we can say that imitation cannot be involved in the primary process of language learning, comprehension. A further limitation is that even in the domain of production, imitation is *not* involved in the

construction of sentences. Abstract rules cannot be imitated for the simple reason that rules do not exist in the physical world. Of course, the output of rules, speech, exists in the world but not the rules themselves; rules are formulations that involve observable entities. This is not to say that imitation is not important. It is, but it is limited to the development of the articulation of speech sounds and the sound pattern of sentences.

1.5.2 Productivity by rule

The child's production of certain novel words and sentences cannot be explained by imitation. Children commonly produce ungrammatical words like:

1. 'sheeps', 'mouses', and 'gooses', regarding the PLURAL, and
2. 'goed', 'comed', 'falled', and 'breaked', regarding the PAST.

Why do they utter such words? It *cannot* be because of imitation because rarely would anyone say such words for them to imitate. Similarly, why do children utter such ungrammatical sentences as:

1. 'No heavy' and 'No the sunshine', regarding the Negative, and
2. 'When we can go?' and 'He is doing what?', regarding the Question.

They cannot be imitating such speech because no one says these things for the child to copy.

Clearly, children have formulated *rules* in their minds from which they construct novel utterances. They learn the PLURAL morpheme and the PAST tense morpheme and then apply those to new cases. This works when the new words are regular, such as hat/hats and fish/fishes, and carry/carried and push/pushed. However, when the new word is an exception, the child must learn that it is an exception and not apply the rule. This explains why the child produces PLURAL words like 'sheeps' and 'mouses'.

What are especially interesting are the creations that the child makes with the PAST regular rule: 'goed', 'comed', 'falled', 'breaked'. Typically before the PAST rule was learned, the child had already learned many of the PAST irregular forms, especially go/went and come/came. The power of the PAST rule is so strong that the formerly learned irregular past forms of 'went' and 'came' are disregarded or confused. Sometimes the child will even produce forms like 'wented' and 'camed'. Thus, the child typically slips and loses some of the earlier learned past irregular forms. The child has then to relearn them. The child develops rules in the mind and then uses those rules to make these novel creations. These rules are so powerful that they strongly control the child's output.

Morpheme and structure rules are learned by children and, when they are, they may strongly affect production. Undoubtedly the proper forms can be understood when such forms are spoken to the child. It is a different

matter, however, for the child to learn the restrictive application of such rules. There are always exceptions.

1.5.3 The frequent futility of correction

It used to be thought by many that the correction of children's speech is essential to improvement. Research has shown, though, that such is not the case, with parents typically paying little attention to the grammatical correctness of their children's speech (Brown *et al.*, 1969; Brown, 1973). When parents do attempt to correct their children's speech, the results are often fruitless and frustrating.

Undoubtedly, there are cases where parents' corrections, particularly with older children, may directly result in improvement. However, because grammatical corrections are relatively rare with respect to the number of deviant utterances that a child actually produces, it is reasonable to conclude that correction does not play an important role in grammar learning. Eventually, the child does notice his or her own incorrect speech and then makes the necessary revision.

It is worth noting that 'correction' typically takes the form of a corrected repetition of the child's utterance. This may not be helpful because, in order to improve, the child must: (1) note the difference between the child's own utterance with that of the parent, (2) determine what the nature of the error is, and (3) figure out a way to permanently change his or her grammar or strategies so that it yields the parent's utterance in the future. This is quite a burden for a child, so much so that the child typically ignores the attempt at correction. The alternative of telling the child what the nature of the problem is often worse, e.g. 'add *do* when you are making a Negative with a Verb rather than *be* and place *do* in front of the Verb'. Most parents are more interested in the truth value, social appropriateness, or cleverness of what their children say than they are in the ungrammaticality of the utterances of their children. A child who says, 'I no broked it' when she did commit that act may not receive a grammatical correction such as 'You should say, "I didn't break it" ', but more likely will receive a scolding if she is lying. Similarly, a child who says to a visiting aunt, 'Mommy no like you' will be given a scolding not for grammaticality but for good manners.

1.6 Learning abstract words

When acquiring the meanings of words, children begin with the concrete and go on to the abstract. They begin with *physical objects* ('mama', 'dog', 'ball', 'table') and *direct activities* ('run', 'jump', 'play', 'give') then move to relations and statives ('on', 'sitting'). Soon following will be words involving *mental experiences and relations* ('hungry', 'hurt', 'happy', 'want'), which

then yield such utterances as 'Mary hurt', 'John thirsty', and 'Kitty want eat'. Later come *complex abstract ideas* ('I', 'you', 'truth', 'lie', 'honest', 'guess', 'hope', 'idea', 'thought').

But how are these words learned, especially the complex and abstract ones? While simple association is sufficient for an item such as 'dog' where the speech sound 'dog' is associated with the object 'dog', complex hypothesizing needs to be employed for learning the words for feelings and concepts, since these are not in the physical environment for the child to directly observe. The child must make inferences from what people say, and on the basis of what happens in the environment and the mind. Such learning at first glance seems to be so mysterious as to be almost magical, yet the fact is that children *do* learn such words. The first author offers the following ideas to explain how such learning occurs.

For example, how might the words 'hungry' and 'hurt' be learned? First the child must take note of when such words are spoken by others and the situations in which they occur. The child might cry and the mother might then say, 'Are you hungry?' The mother says this because the mother guesses what the child's internal state might be, based on when the child last ate, for instance. If the child has the feeling of hunger, the child may then guess (after some repeated instances) that 'hungry' refers to what he or she is feeling. Or, the child might point to a banana and the mother might say in response, 'Do you want a banana?' and the child might get the meaning of 'want'. Consider 'hurt'. Perhaps the child falls and is bruised on the knee. The father might say, 'Poor girl. Does it hurt?' The child's feeling of pain might then be associated with the word 'hurt'. Or, on receiving an injection with a syringe, the child cries, and the father says, 'It hurts, doesn't it? Poor child.'

It is up to the child to remember what words were spoken, e.g. 'hungry' and 'hurt', and to relate them to particular feelings that the child has experienced in the mind, 'hunger' and 'pain'. After a number of such instances where certain words (spoken by others) and certain feelings are experienced together, the child will have enough information to make a guess at which sound form relates to which feeling. When the child then experiences further instances, the child can test whether he or she is correct, i.e. whether the sound form of 'hungry' relates to the feeling of hunger and the sound form of 'hurt' relates to the feeling of pain. (See Gillette *et al.*, 1999, for a considered discussion on how verbs of mental experience, e.g. 'think', 'know', and 'like', can be learned.)

Words like 'lie' (falsehood) and 'guess' must also have particular environmental situations and mental states for the child to bring together. These will be more difficult to identify than feelings because they involve pure (non-feeling) ideas. The child will have to make logical inferences from complex situations in order to extract such ideas. For example, suppose after telling his mother something that he knows is untrue, 'I didn't hit her', the little boy's mother might say angrily, 'That's a lie!' What the little boy must do to discover the meaning for this sound form of 'lie' is to recall the intention

and what he knew in his mind before he said what he said. He knows that what he said ('I didn't hit her') did not correspond with what had actually happened before in the world (he *did* hit her). Once he has this situation in mind, the boy can assign a meaning to the sound form of 'lie', thereby learning the meaning of the word 'lie'. He comes to realize that the discrepancy between what he says and the situation or event in the world is the meaning of the sound form /lai/, and then assigns this concept to the sound form. Whether this hypothesis is accurate or not is something the child will test when he hears the word 'lie' again.

The use of metaphor too will help children to comprehend abstract concepts. Metaphoric language extends a child's experience of the world by exposing hidden meanings of already familiar words and phrases. The book by Lakoff and Johnson (1980), *Metaphors We Live By*, is very suggestive as to how children could learn abstract meanings by hearing metaphorical usage, although this is not the intent of the book. For example, a child hears his father tell him, 'I'm glad you saw the light', after the child has told the truth about something he had been lying about. The child hears the word 'light' used in this special way for the first time and tries to guess at the intended meaning. Considering the situation and the ordinary meaning of light, the child hypothesizes that it may mean something like the right way or the correct thing to do. Thus, as Holme (2004) argues, metaphors can also be a powerful tool in second-language learning and teaching.

1.7 Memory and logic in language learning

1.7.1 Memory

Underlying all of the remarkable accomplishments of the child in language learning is one crucially important psychological factor, that of memory. For, in the course of learning to identify the words of the language, devising rules for their use, and relating speech to the environment and mind, the child utilizes a phenomenal memory capacity. The child must remember a multitude of particular words, phrases, and sentences, along with the contexts, both physical and mental, in which they occurred. Such data provide the basis for structural analyses and vocabulary learning.

If children did not remember many of the words, phrases, and sentences they heard, they would have little basis for discovering abstract meanings and rules. The various syntactic structures that were mentioned and discussed earlier, negation for instance, require that the child remember previously experienced negative sentences. If the child could not remember negative sentences that had been experienced previously, the child would have nothing with which to compare a presently occurring sentence, and thus could not make significant inferences as to its structure.

Without a good memory, language learning would not be possible. Some recent studies of patients with semantic short-term memory deficit demonstrate that such persons are unable to comprehend and produce structures that involve more than one word meaning; for example, they can not produce an Adjective–Noun phrase, or process grammatical relations (Martin and Freedman, 2001; Martin and He, 2004).

Aside from the common observation that children often remember, word for word, stories that they are told, children also learn a host of idioms in phrase and sentence form. There is no reason, therefore, not to believe that children also store in memory a multitude of ordinary phrases and sentences, which can serve them for analysis later. Children as young as 8 months can begin to remember speech sounds. This was demonstrated by the infants' preferential listening patterns to words heard in children's stories that were read to them (Jusczyk and Hohne, 1997). The infants turned their heads more towards the sound of the words that had occurred in the stories than towards unfamiliar words. Such a prodigious memory capacity, it is worth noting, is not unique to language. For in many other areas of life – in remembering faces, objects, music, past events, and vast quantities of knowledge in a variety of domains – the extent of a child's memory is similarly remarkable.

1.7.2 Logic

In learning language, the child must use both induction and deduction in the analysis of words and sentences and the formulation of grammar and strategies.

Young children use INDUCTIVE logic

Even in the early grammatical phase of learning basic morphemes, e.g. Progressive, Plural, and Third Person, children must use an inductive analysis. Taking the Plural as an example, children must scan the sentences uttered by mature speakers and then note that a suffix is added when two or more objects are being talked about. The children then formulate a rule in their minds. This rule is tested when the children hear other sentences uttered by the mature speakers. This type of analysis, where (1) there is a search for characteristics in speech, and then (2) those characteristics are related to objects, situations, and events, represents the essence of the use of inductive logic. An abstract rule or principle is gleaned on the basis of actual data.

Young children use DEDUCTIVE logic

The child's production of speech, even in the early years, reflects a great deal of conceptualization and thinking on the part of the child. Suppose one 4-year-old child (Rose) says to another child (Tom), 'You have more than

me!' This is said in a situation where an adult has put down a plate of cookies in front of the two children and the children have made a grab for them. Then suppose that, after Rose has said this, Tom, the child with the greater number of cookies, gives some to Rose, the child with the lesser number.

Now we may ask, why did Tom give Rose some cookies? What was it about what Rose said that persuaded him to behave the way that he did? Rose must have implied the following logical argument:

Premise 1 You have more cookies than me.
Premise 2 We should have an equal amount.
Conclusion You should give me some of your cookies to make it equal.

The fact that Tom responds to Rose's simple declaration, 'You have more than me!' by giving her some cookies indicates that Tom understood her argument. He did not consider her sentence as simply stating a fact. Both children understood the logical argument implied by Rose's statement.

Such an advanced level of conceptual development may surprise many of us, especially some Piagetian theorists, who, relying on such limited notions as 'conservation', believe that deductive logic develops after the age of 6 years (Piaget and Inhelder, 1969). A proper language analysis, such as the one above, demonstrates that age norms for the development of deductive logic must be drastically revised downwards. As for inductive logic, norms have yet to be established, but they surely would have to be below the child's second or first year.

Then, too, according to Piaget, intelligence has its basis in the child performing actions with respect to objects in the world. Here, also, Piaget was mistaken. Such actions are not essential to the development of intelligence or language. As we noted earlier with the cases of virtually paralyzed persons like Nolan and McDonald, their inability to perform such actions did not prevent them from developing high levels of intelligence and language.

The 1- and 2-year-old child is quite an intellectual marvel whose thinking powers should not be underestimated.